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Netta et al.

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[54] **TIE EJECTING APPARATUS IN A BUNDLING TIE APPLYING TOOL**

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[51] **Int. Cl.**[3] **B21F 9/02**

[52] **U.S. Cl.** **140/123.6**; 140/93.2

[58] **Field of Search** ..... 140/49, 52, 56, 57, 140/93 R, 93 A, 93.2, 123.6; 100/6, 33 PB

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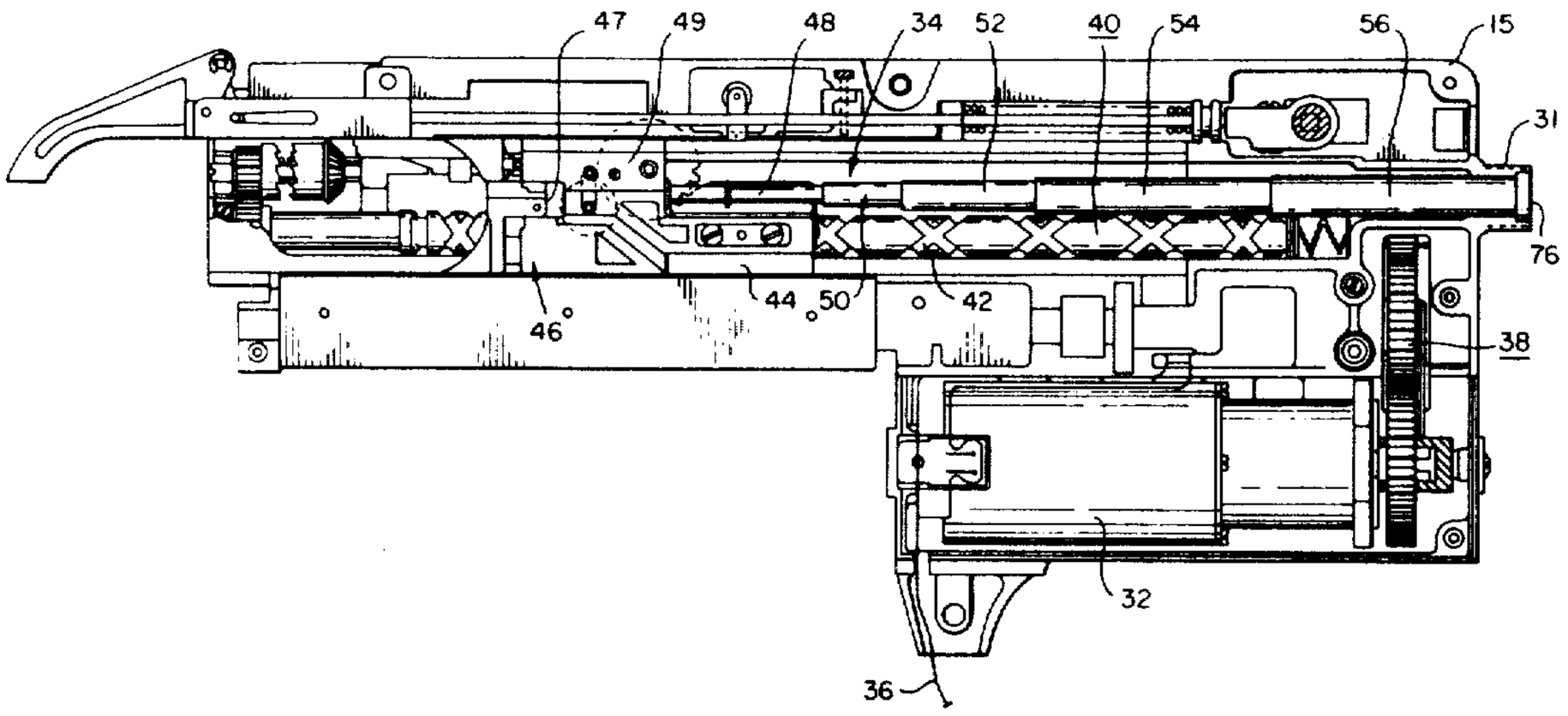
[57] **ABSTRACT**

A tie scrap ejecting apparatus is provided in a bundling tie applying tool for positive controlled ejection of a portion of a bundling tie severed upon being suitably tensioned about a plurality of articles. The ejecting apparatus includes a plurality of tubes, interconnected for slidable, telescopic movement. The smallest of the tubes is coupled to a movable support that supports the tie severing means and is thereby movable therewith. The smallest tube has a passageway for close passage of a severed tie therethrough, the passageway communicating with the severing means. The largest tube is stationarily affixed to the housing, its opening communicating with a port of egress for discharging the severed tie portion. The other tubes are movable with respect to the largest tube, each of the movable tubes having an end surface that upon collapsing of the apparatus lies closely adjacent the port of egress for pushing a severed tie portion therethrough.

23 Claims, 5 Drawing Figures



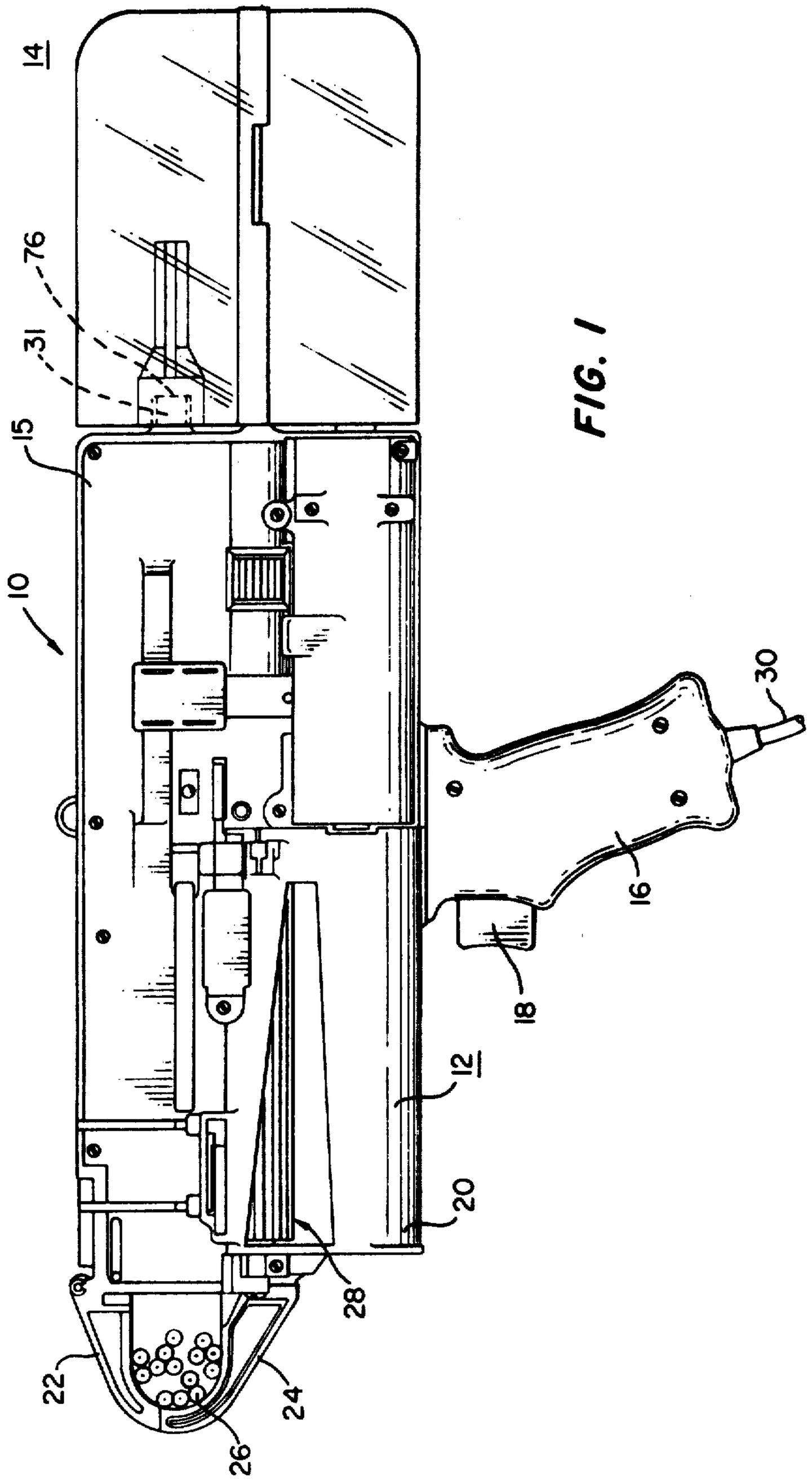


FIG. 1

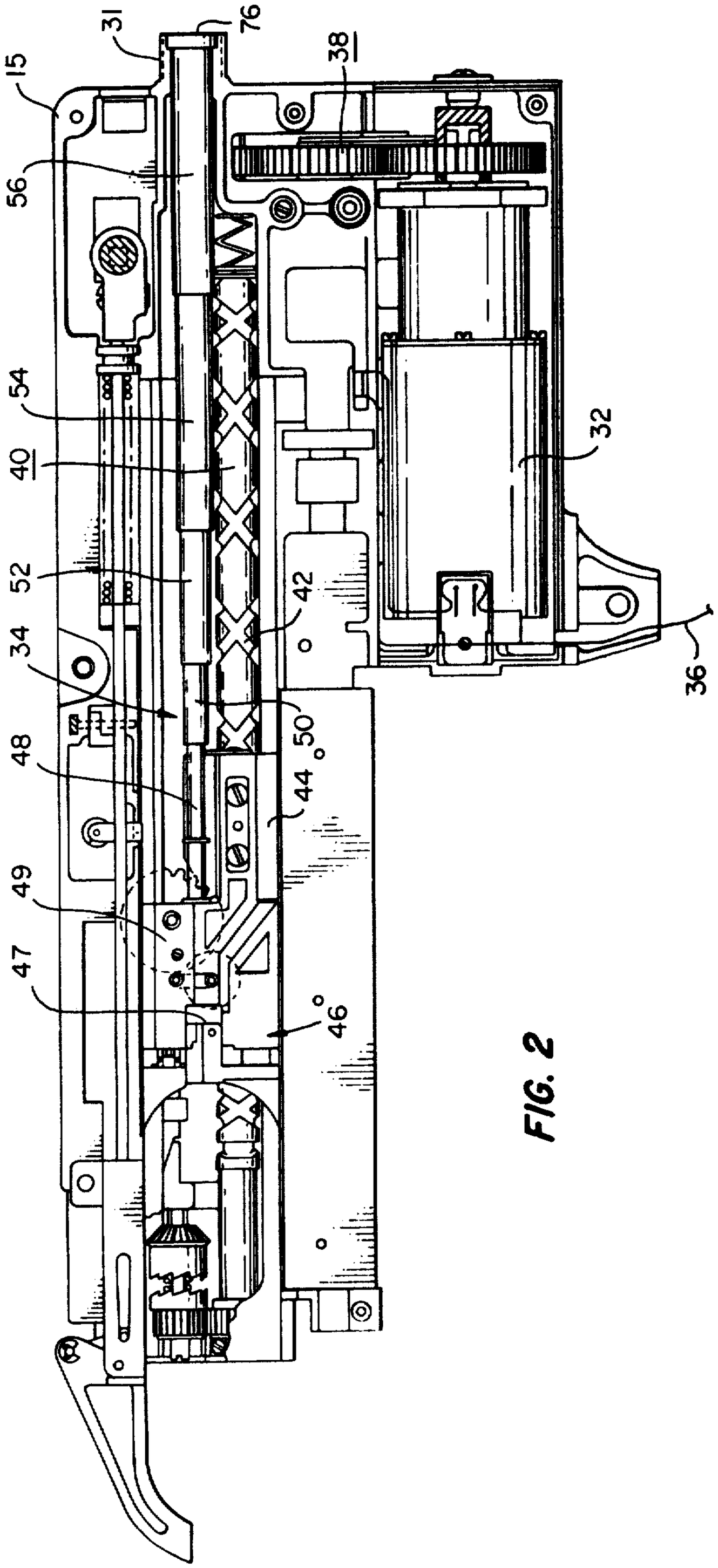


FIG. 2

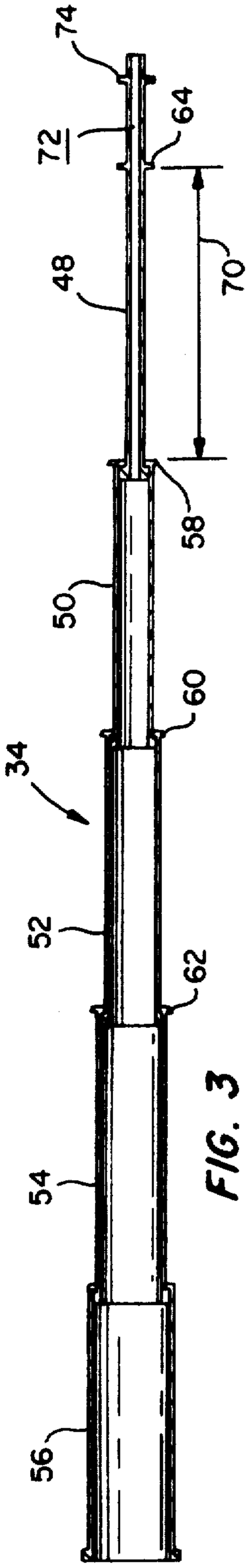


FIG. 3

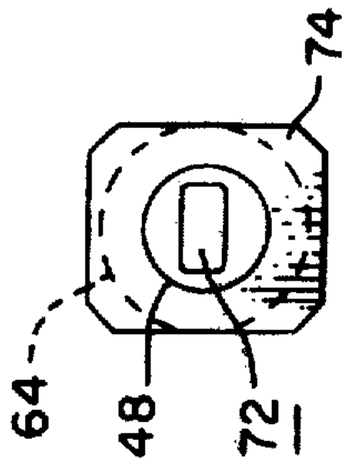


FIG. 5

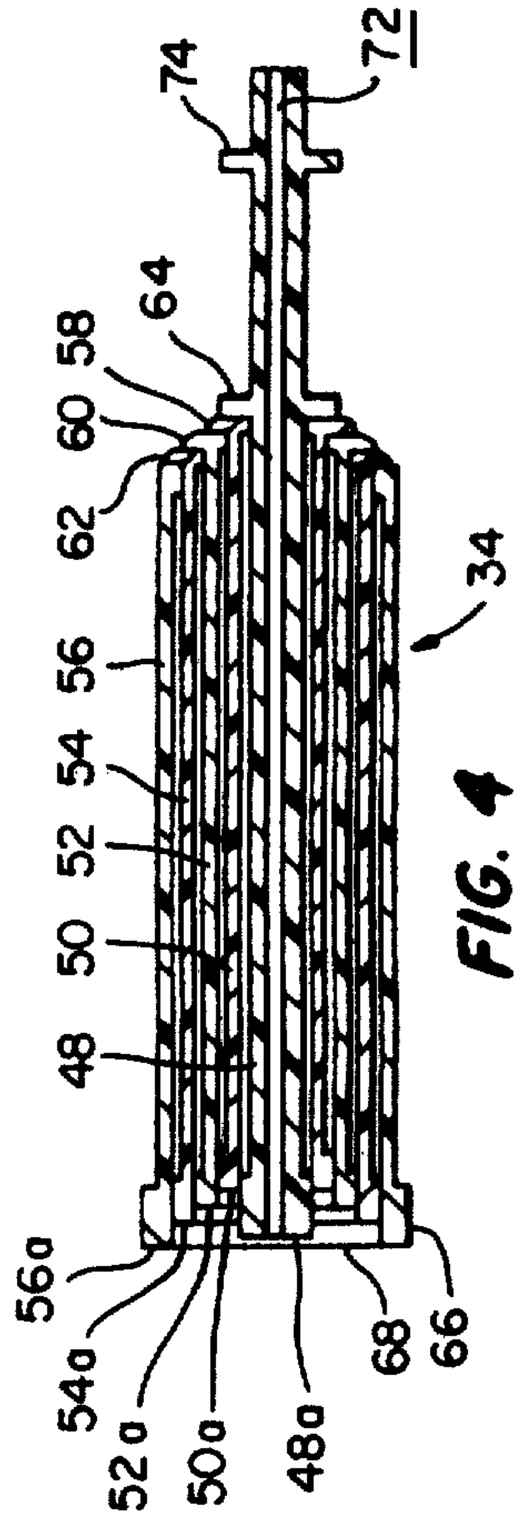


FIG. 4

TIE EJECTING APPARATUS IN A BUNDLING TIE APPLYING TOOL

FIELD OF THE INVENTION

This invention relates to a bundling tie applying tool and, more specifically to a tie ejecting apparatus in such a tool for controllably discharging severed excess bundling tie portions. The present invention is particularly, but not exclusively, useful in the type of tool disclosed in copending patent application, Ser. No. 230,687, filed concurrently herewith, entitled "Bundling Tie Applying Tool," and assigned to the same assignee as is the present invention.

BACKGROUND OF THE INVENTION

Tools for applying bundling ties about wires in harnesses or about other articles are generally known and may be manual, semi-automatic or automatic. Because of high production demands, the automatic tool has become popular. The automatic tool typically includes means for positioning a bundling tie about the wires, tensioning the ties and then severing the tie upon being suitably tensioned. After the ties are suitably severed upon being tensioned, the excess tie portions are discharged from the tool. While in some tools discharge is effected by simple release and gravitational discharge, other tools utilize ejecting means for controlling the discharge of the excess tie portions.

In the known ejecting mechanisms, controlled discharge is provided by contoured deflecting surfaces or spring biased guides for reducing the tendency of a severed strap to be propelled. In one tool utilizing a rotary driven wheel to tension the tie, the excess strap portion, upon being severed, is propelled out the top of the tool by the rotary driven member. In another tool utilizing a rotary driven member the tie, upon being severed, is ejected by the driving mechanism and guided by ejector plates to an opening in the bottom of the tool through which the scrap is discharged. In another tool arrangement, discharge of the severed tie portion is effected by the snapping action of a tie threading block under the influence of a compression spring to expel the excess tie portion through an aperture in the tool housing.

In discharging severed tie portions, one of the problems encountered, in particular in the automatic tool where a rapid succession of tie application is desired, is the assurance of positive ejection. Improperly ejected tie scraps can result in tool jamming and damage, leading to costly delays and repairs.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved tie ejecting apparatus in a bundling tie applying tool.

It is another object of the present invention to provide an ejecting apparatus for facilitating positive ejection of the tie scraps from a bundling tie applying tool.

In accordance with the invention, tie ejecting apparatus is provided in a bundling tie applying tool for installing an elongate bundling tie about a plurality of articles to be bundled. The tool is of the type having a housing, means for severing a portion of a tie positioned about the articles and a port of egress on the housing for the discharge of the severed tie portion. The ejecting apparatus comprises means within the housing defining a closed course extending from the severing means to the port of egress for receiving and containing therein a severed tie portion. Included is plunger means movable within the enclosed course to a position closely adjacent the port of egress for engaging and pushing therethrough a severed tie portion positioned in the enclosed course.

In the preferred form, the means defining the enclosed course includes a plurality of telescopically collapsible hollow tubular members that are movable from a first extended length to a collapsed shortened length. A tubular member at one end is stationarily affixed to the housing with its opening communicating with the port of egress. The other tubular members are slidably movable with respect to the fixed tubular member. A tubular member at the other end is coupled to a movable support that supports the severing means, such tubular member having a passageway communicating with the severing means. Each of the movable tubular members has an end surface movable within the enclosed course such that upon being collapsed, the end surface of each tubular member is positioned closely adjacent to the port of egress to engage and push a severed tie portion therethrough.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a side elevational view of a power-operated, automatic bundling tie applying tool embodying the present invention.

FIG. **2** is a side elevational view of the tool of FIG. **1** with the left side of the tool housing removed to show the present invention as assembled in the tool.

FIG. **3** is a side sectional view of the tie scrap ejector mechanism in accordance with a preferred embodiment of the invention.

FIG. **4** is an enlarged, side sectional view of the ejector mechanism of FIG. **3** shown in a telescopically collapsed condition.

FIG. **5** is a front elevational view of the ejector mechanism of FIG. **3**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawing, there is shown in FIG. **1** an automatic bundling tie applying tool, generally indicated as numeral **10**, incorporating features of the present invention. The tool **10** is preferably of the type as shown and described in copending patent application, U.S. Ser. No. 203,687, entitled "Bundling Tie Applying Tool," filed on even date herewith, and assigned to the same assignee as is the present invention. In brief, the tool **10** is an electrically powered tool capable of installing a bundling tie of the self-locking type having an apertured head portion and an elongate, flexible strap portion extending therefrom. The ties may be of the type shown and described by Noorily in U.S. Pat. No. 3,973,293, assigned to the same assignee as is the present invention. The tool **10** has means for receiving ties individually from a series of such bundling ties interconnected between adjacent head portions by a web. Means are included in the tool **10** for advancing the ties to a separating station whereat the web between each head portion is cut thereby providing separated, individual ties. The separated ties are further advanced to a feeding station whereat a reciprocating member feeds and positions an individual bundling tie in a closed loop about the articles to be bundled. Included are means for tensioning the tie about the articles and means for sever-

ing the tensioned tie, preferably at a predetermined tension.

Generally, the tool **10** comprises a housing **12**, a scrap container assembly **14** suitably attached to the rearward housing end **15** and a handle **16** with a trigger **18** mounted therein. The scrap container **14** suitably collects severed excess tie portions upon being ejected through a discharge port **31** by the ejecting means of the present invention, as will be described. At the forward end **20** of the housing **12** where the ties are applied to a bundle of articles, there are a pair of hook members **22** and **24**. The lower hook member **24** is stationary while the upper hook member **22** is movable with respect thereto. The movable upper hook **22** is movable to a position for receipt of a plurality of wires **26** to be bundled. Once the wires **26** have been received within the confines of the hooks **22** and **24**, the upper hook is closed to facilitate looping of a cable bundling tie about the wires **26**. The tool **10** includes a tie carrying mechanism **28** for supporting a plurality of ties thereon and subsequently advancing the ties to a position in preparation for looping about the wires **26**.

As further shown in FIG. **1**, extending from the bottom portion of the handle **16** is a suitable electric cord **30** for providing electric power to the tool **10**. The cord **30** is connected to a suitable source (not shown) of electrical power. The source may be a power supply capable of converting conventional line 110 volt or 220 volt alternating current to direct current for operating an electric motor housed within the tool **10**. Alternatively, the source may be a battery supply capable of providing requisite direct current to the tool **10**.

Turning now to FIG. **2**, details of the tool drive mechanism for effecting movement of an ejector mechanism **34** are shown. A direct current motor **32** is suitably connected as by a line **36** to the power source supplied to the tool through cord **30** (FIG. **1**). The motor **32** is suitably coupled by a gear train **38** to a drive shaft **40** suitably mounted in the housing **12** for rotation. The drive shaft **40** has a double helical groove **42** extending axially therealong on which a carriage **44** linearly reciprocates during shaft rotation. Suitably connected to the carriage **44** for reciprocating movement therewith is a tie feeding mechanism, generally designated as numeral **46**. One function of the tie feeding mechanism **46** is to engage a bundling tie and feed such tie to the hooks **22** and **24** whereat they are looped about articles to be bundled. The tie feeding mechanism **46** also supports for movement therewith a tie severing mechanism **47** for severing the excess portion of the bundling tie upon being suitably tensioned about the wires **26** by a tie tension mechanism **49**. The scrap ejector mechanism **34** is suitably coupled to the tie feeding mechanism **46** to facilitate operation of the ejector mechanism as will be described.

Referring to FIGS. **3**, **4** and **5**, the details of the scrap ejector mechanism **34**, for positive, controlled ejection from the tool **10** of a severed tie portion may be appreciated. The ejector mechanism **34** comprises a plurality of elongage, hollow cylindrical tubes **48**, **50**, **52**, **54** and **56**, interlocked together for telescopic, collapsible movement. Such tubes define an enclosed path between the severing mechanism **47** in the movable tie feeding mechanism **46** and the discharge port **31**. Although five tubes are shown in the preferred arrangement, it should be understood that any other number of tubes, with at least two, may be used. Each of the tubes from the tube **48** to the tube **56** has a successively increasing outer diameter. The outer diameter of each of the tubes, except the largest tube **56**, is formed to have a close sliding fit with the inner diameter of the succeeding tube. Thus, tube **48** slides closely within tube **50**, and tube **50** within tube **52** and so on.

Tubes **50**, **52** and **54** have at the tube receiving ends radially projecting abutments **58**, **60** and **62**, respectively, serving as stops for the succeeding tubes thereon. Tube **48** has a spacer **64** serving as a stop for the tube **50** and as a means for pushing the tubes into a completely collapsed condition. The spacer **64** is positioned on the smallest tube **48** at a preselected axial distance **70** from the succeeding tube **50** to provide engagement therewith during reverse movement of the tube **48**, as will be described, and thus provide pushing of the tubes into the completely collapsed condition. Upon reverse movement of the tube **48**, the spacer **64** engages the tube **50**, abutment **58** engages the tube **52**, abutment **60** engages the tube **54** and abutment **62** engages the largest tube **56**. A completely collapsed mechanism **34** is shown in FIG. **4**. The tube lengths are formed such that the tube end surfaces **48***a*, **50***a*, **52***a*, **54***a* and **56***a* of the completely collapsed mechanism **34** at the discharge end **66** lie closely adjacent an end plane **68**. As defined in this context, the term "closely adjacent to" includes the positions wherein, the end surfaces of the tubes at the mechanism end **66** are at, closely interiorly within the end plane **68** or closely exteriorly beyond the end plane **68**. For example, in the preferred embodiment, the lengths of the tubes **50**, **52**, **54** and **56** are formed for manufacturing purposes to be approximately the same. The abutments **58**, **60** and **62** are formed to have small axial extents, on the order of mils, so that when the tubes are collapsed, thee tube end surfaces at mechanism end **66** will be slightly staggered but, nevertheless, closely adjacent to the end plane **68** as shown in FIG. **4**. It should be appreciated that the lengths of the tubes may be formed to compensate for the axial extent of the abutments, whereby all the tube end surfaces will lie in a substantially common plane at the plane **68** in the collapsed mechanism. Thus, other than a small opening **72** extending through the tube **48**, the end surfaces of tubes in the collapsed condition at the end **66** define, with close fitting interfaces, a substantially solid cross-section thereat in a direction transverse the longitudinal direction of the ejecting mechanism **34**.

As shown in FIG. **5**, the opening **72**, extending lengthwise throughout the tube **48**, is preferably rectangular and adapted to closely receive axially therethrough the excess tie strap portion of rectangular cross-section that is severed in the tie feeding mechanism **46** illustrated in FIG. **2**. The tube **48** is provided with a flange **74** for connecting the tube **48** to the tie feeding mechanism **46** such that the opening **72** is positioned in communication with the tie severing mechanism **47** to receive the excess tie strap upon being severed. The tie tensioning mechanism **49** propels a severed tie portion from the severing mechanism **47** into the opening **72** in the tube **48**. As shown in FIG. **2**, the ejector mechanism **34** is mounted in the tool with the largest tube **56** suitably stationarily affixed to the housing **12** and opening into an aperture **76** of the housing discharge port **31** at the tool rearward end **15** for egress of the severed tie portions. The smallest tube **48**, being connected to the feeding mechanism **46** is movable therewith. Upon linear reverse movement of the tie feeding mechanism **46** during the tool operation, the smallest tube **48** is slid telescopically into the succeeding

tube **50** until the spacer **64** engages the tube **50**. At such engagement the tube **50** is slidably pushed by the spacer **64** into the next succeeding tube **52** until the abutment **58** on the tube **50** engages the tube **52**. The tubes are telescopically collapsed in this fashion until the feeding mechanism **46** reverses direction along the rotating shaft **40**. At the point where the tie feeding mechanism **46** has reached the end of its rearward stroke, the ejector mechanism **34** is in its completely collapsed condition as described heeinabove. Upon linear forward movement of the tie feeding mechanism **46**, the tubes are slid telescopically to their full extension at the forward end of the stroke of the tie feeding mechanism **46**.

In operation, a tie strap is severed while the feeding mechanism **46** is temporarily stationary at the forward end **20** of the housing and the ejector mechanism **34** is thereby extended. Due to the high velocity of the tie tensioning mechanism **49**, as the strap is severed it is thrust into the opening **72** and therethrough where it may or may not be propelled through the port opening **76**. Should the severed excess strap portion be contained within one of the tubes, having exited the opening **72**, the strap portion will be pushed out the port opening **76** by the end surfaces of the collapsing tubes during reverse movement, which effectively form the nearly solid wall when completely collapsed as described herein. Should the strap portion fail to exit the opening **72**, upon severing of the subsequent tie strap, the subsequent scrap portion will push the first scrap portion out the opening **72**, as the rectangular opening is restricted to axially receive and contain only one tie strap at a time.

Having described the ejector mechanism **34** of the present invention in the preferred embodiment of a telescopically collapsible tubular arrangement, it should be appreciated that other variations are contemplated within the scope of the invention for controllably discharging severed tie portions. For example, a collapsible bellows-type structure may be used to provide an enclosed course with a pushing member or plunger being movable therewithin. Such a plunger may have a surface movable to the port of egress of the housing as at the opening **76** so as to engage and push a portion of the severed tie therethrough.

Although the present invention is described herein in the context of an automatic power-operated bundling tie applying tool capable of receiving a series of webbed ties and cutting the webs therein, it should be appreciated that the contemplated scope of the invention is not so limited. For example, the invention may be used in tools for applying bundling ties wherein separate ties are supplied individually to the tool from a cartridge, hose or other loading device. Moreover, the tool may also be semi-automatically operable or manual.

Various other changes to the foregoing, specifically disclosed embodiments and practices will be evident to those skilled in the art. Accordingly, the foregoing preferred embodiments are intended in an illustrative and not in a limiting sense. The true spirit and scope of the invention are set forth in the following claims.

What is claimed is:

1. In a bundling tie applying tool for installing an elongate bundling tie about a plurality of articles to be bundled, said tool being of the type having a housing, means for severing a portion of said tie positioned about said articles and a port of egress on said housing for the discharge of said severed tie portion, tie ejecting apparatus comprising:

means within said housing defining an enclosed course extending from said severing means to said port of egress for receiving and containing therein a severed tie portion; and

plunger means movable within said enclosed course to a position closely adjacent said port of egress for engaging and pushing therethrough a severed tie portion positioned in said enclosed course.

2. Ejecting apparatus according to claim **1**, further including means for introducing said severed tie portion into said enclosed course.

3. Ejecting apparatus according to claim **2**, wherein said introducing means includes a passageway in said plunger means for passage therethrough of a severed tie portion from said severing means to said enclosed course.

4. Ejecting apparatus according to claim **3**, wherein said passageway is of dimension to closely pass said severed tie portion.

5. Ejecting apparatus according to claim **4**, wherein said passageway is rectangular in cross-section.

6. Ejecting apparatus according to claim **1**, wherein said housing is elongate and said enclosed path extends longitudinally thereof and wherein said plunger means has a surface extending in a direction transverse the longitudinal direction.

7. Ejecting apparatus according to claim **6**, wherein said means defining an enclosed course comprises a hollow tubular member.

8. Ejecting apparatus according to claim **7**, wherein said plunger means comprises an elongate tube slidable within said hollow tubular member, said elongate tube having an aperture for passage of a severed tie portion therethrough from said severing means to the interior of said hollow tubular member.

9. Ejecting apparatus according to claim **8**, wherein a peripheral portion of said tube has a close sliding fit with an inner portion of said hollow tubular member.

10. Ejecting apparatus according to claim **7**, wherein said plunger means comprises a plurality of hollow elongate tubes interconnected together and telescopically slidable longitudinally within said hollow tubular member, each of said tubes having a surface extending in a direction transverse the longitudinal direction, each of said surfaces being slidable to a position adjacent said port of egress.

11. Ejecting apparatus according to claim **10**, further including means for pushing said tubes into a completely collapsed condition wherein the transverse surfaces of each of said tubes lie adjacent said port of egress.

12. Ejecting apparatus according to claim **11**, wherein said pushing means comprises a stop member on one of said tubes.

13. Ejecting apparatus according to claim **11**, wherein said tubes are generally cylindrical and are of successively increasing diameter and dimensioned for close sliding fit between such tubes and between the largest of said tubes and said hollow member, an inner portion of said smallest tube defining a passageway closely configured to the cross-section of said bundling tie for close passage therethrough of a severed tie portion from said severing means.

14. Ejecting apparatus according to claim **13**, wherein said stop member is disposed on the smallest of such telescopically slidable tubes.

15. In a bundling tie applying tool for installing an elongate bundling tie about a plurality of articles to be

bundled, said tool being of the type having a housing, means for severing a portion of said tie positioned about said articles and a port of egress on said housing for the discharge of said severed tie portion, ejecting means comprising:

means defining an enclosed course extending from said severing means to said port of egress for receiving and containing therein a severed tie portion, an extent of said enclosed course being collapsible from a first extended length to a second shortened length;

a pushing member extending within said enclosed course and movable relative thereto and having an opening for passage of a severed tie portion from said severing means to said enclosed course, said pushing means having a tie pushing surface movable to lie within said enclosed course at a location spaced from said port of egress at said first extended length, and to lie closely adjacent said port of egress at said second shortened length of said collapsible portion.

16. Ejecting apparatus according to claim **15** wherein said opening is of dimension for closely passing said severed tie portion.

17. In a bundling tie applying tool for installing an elongate bundling tie about a plurality of articles to be bundled, said tool being of the type having a housing, means for severing a portion of said tie positioned about said articles, a movable support supporting said severing means and a port of egress on said housing for the discharge of said severed tie portion, tie ejecting apparatus comprising:

a plurality of telescopically slidable elongate hollow members defining a collapsible portion of an enclosed course extending from said severing means to said port of egress for receiving and containing therein a severed tie portion;

a first member of said plurality of members having an opening communicating with said port of egress and being stationarily affixed to said housing, the other members being slidably movable with respect thereto;

a second member of said plurality of members having a passageway extending longitudinally therethrough for close passage of a severed tie portion and being coupled to said movable support, said passageway being in communication with said severing means,

said telescopically sliding members, in response to the movement of said support, moving slidably from a first extended length to a second collapsed length,

each of said movable members having an end surface movable within said enclosed course, each end surface being positioned at said extended length to lie within said enclosed course longitudinally spaced from said port of egress and at said collapsed length to lie closely adjacent said port of egress.

18. Ejecting apparatus according to claim **17**, further including means responsive to the movement of said movable support for telescopically sliding said members to said second collapsed length whereby the end surfaces of such members lie closely adjacent said port of egress.

19. Ejecting apparatus according to claim **18**, wherein said sliding means comprises a pushing element disposed on said first member.

20. Ejecting apparatus according to claim **17**, wherein said elongate hollow members comprise a plurality of generally cylindrical tubes of successively increasing diameter and interconnected together, each of said tubes being dimensioned for a close sliding fit with a preceding tube therein.

21. Ejecting apparatus according to claim **20**, wherein the smallest of said tubes is coupled to said support and the largest stationarily affixed to said housing.

22. Ejecting apparatus according to claim **21**, wherein each of said tubes has a length whereby the end surfaces on each tube are positioned longitudinally successively within said enclosed course at the first extended length of said plurality of tubes.

23. Ejecting apparatus according to claim **17**, wherein said passageway is substantially rectangular in cross-section.

* * * * *